

Helsinki 12.10.2000

CT/FI 0 0 / 0 0 7 4 1

REC'D 31 OCT 2000

WIPO

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PRIORITY DOCUMENT

F100/0074



Hakija  
Applicant

Nokia Telecommunications Oy  
Helsinki

10/069485

Patenttihakemus nro  
Patent application no

19991873

10/069485

Tekemispäivä  
Filing date

02.09.1999

Kansainvälinen luokka  
International class

H04M

Keksinnön nimitys  
Title of invention

"Customizing prepaid service"  
(Ennaltamaketun palvelun mukauttaminen)

Hakijan nimi on hakemusdiaariin 05.12.1999 tehdyn nimenmuutoksen jälkeen **Nokia Networks Oy**.

The application has according to an entry made in the register of patent applications on 05.12.1999 with the name changed into **Nokia Networks Oy**.

Täten todistetaan, että oheiset asiakirjat ovat tarkkoja jäljennöksiä patentti- ja rekisterihallitukselle alkuaan annetuista selityksestä, patenttivaatimuksista, tiivistelmästä ja piirustuksista.

This is to certify that the annexed documents are true copies of the description, claims, abstract and drawings originally filed with the Finnish Patent Office.

*Marketta Tehikoski*

Marketta Tehikoski  
Apulaistarkastaja

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Maksu 300,- mk  
Fee 300,- FIM

Osoite: Arkadiankatu 6 A  
P.O.Box 1160  
FIN-00101 Helsinki, FINLAND

Puhelin: 09 6939 500  
Telephone: + 358 9 6939 500

Telefax: 09 6939 5328  
Telefax: + 358 9 6939 5328

## Customizing prepaid service

### Background of the invention

The present invention relates to a method and equipment for customizing prepaid service.

5 In telecommunications systems, such as the pan-European digital mobile communications system GSM (Global System for Mobile Communications), the use of prepaid SIM (Subscriber Identity Module) cards is increasing. Prepaid SIM cards relieve the network service providers of credit losses. They enable parents to set an upper limit for the telephone bill beforehand. As a  
10 third benefit, they enable roaming subscribers to pay their local calls with local tariffs, whereas the use of a SIM card of their home service provider results in paying international tariffs to their home network and back.

Usually service providers allow the subscribers to call an Interactive Voice Response (IVR) service through which the service subscribers can  
15 check their account balance and add more money to their accounts. This money adding is called recharge. Instead of calling the IVR it is possible to also call to the operator's service number. It is also possible to check the account balance and recharge via the SMAP, which is an Internet-based user interface. Recharge is carried out by means of vouchers. Some service pro-  
20 viders sell different types of vouchers, which differ from each other e.g. in the number of call units and expiry time.

One problem with the current prepaid solution is that the attributes of the prepaid service are the same to all subscribers - or at least to all subscribers using the same kinds of vouchers since the attributes are connected  
25 with the voucher. So the operators are not able to offer a customized prepaid service. One example of a prepaid service attribute is how the prepaid subscription data is updated during recharge.

### Disclosure of the invention

The object of the invention is to overcome the above problem. The  
30 object of the invention is achieved with a method, a system and a network element which are characterized in that what disclosed in the independent claims. The preferred embodiments of the invention are set forth in the dependent claims.

The invention is based on defining different subscriber profiles having different attributes and associating subscriber information with an indication of which profile to use with this subscriber.

The advantages of the invention are that the service providers can  
 5 customize their prepaid service without changing the basic service structure by giving different profiles to the subscribers. Thus customizing and changing customized services are very easy.

In one embodiment of the invention the attribute is a deposit function. A further advantage of this embodiment is that other features than the  
 10 voucher value may also be taken into account when calculating a new credit.

In still another embodiment of the invention the attribute is an expiry function. The further advantage of this embodiment is that other features than the voucher validity time may also be taken into account when calculating new expiry dates.

#### 15 **Brief description of the figures**

The invention will be described in further detail in the following by means of preferred embodiments with reference to the accompanying drawings, in which

Figure 1 is a block diagram showing some relevant network elements;  
 20

Figure 2 is a block diagram illustrating different profiles according to a first preferred embodiment;

Figure 3 is a flow chart illustrating subscriber provisioning; and

Figure 4 is a flow chart illustrating the functionality of the invention  
 25 during recharge.

#### **Detailed description of the invention**

Figure 1 is a block diagram of a telecommunications system S equipped with an arrangement according to a preferred embodiment of the invention. The telecommunications network is assumed to be a public land mobile network PLMN yet without limiting the invention to that kind of particular  
 30 network. The invention can be used in any telecommunications systems, where prepaid subscribers have subscription information stored in the system. A prepaid subscriber refers here to a subscriber using prepaid subscription, i.e. a subscriber who has paid in advance. The embodiment illustrated in Figure 1 makes use of Intelligent Network technology. An intelligent network IN is  
 35

able to provide a subscriber of a telecommunications network, such as a wired network or a mobile telephone network, with a plurality of services. An example of such an intelligent network is described in recommendations of the ITU-T Q-1200 series, of which Q-1210 to Q-1219 define a set of features known as CS-1 (Capability Set 1), and correspondingly, Q-1220 to Q-1229 define a set of features CS-2. The invention and its background will be described by the terminology of recommendation ETS 300 374-1 CoreINAP, but the invention can also be employed in intelligent networks implemented according to other intelligent network standards.

Figure 1 shows some elements of an intelligent network which are relevant to the understanding of the invention, such as what are known as intelligent peripherals IP. Usually an IP is associated with a specialized resource function which is an interface for network mechanisms associated with interaction with a subscriber. Therefore an IP comprises usually e.g. more advanced speech handling functions than do exchanges in general. The IVR application is usually located in the IP. The IVR application, also called the PrePaid service IVR application, is an interactive voice response application that allows the subscriber to add money to (deposit, recharge) his PrePaid SIM account by entering the number of a prepaid voucher. The IP is connected to an SSP using for example ISUP (ISDN User Part) signalling and one or more voice transports.

The SSP (Service Switching Point) is a network element performing a service switching function (SSF). The SSP may be a mobile service switching centre MSC, which includes the SSF. The SSF is an interface between a conventional call control function CCF and the service control function SCF of an intelligent network. The network element performing the SCF is called a service control point SCP. An intelligent network service is produced by the service switching point SSP inquiring instructions from the service control point SCP by means of messages to be transmitted across the SSP/SCP interface upon the encounter of detection points associated with the service. In association with an intelligent network service, a service program is started at the service control point SCP, the operation of the program determining the messages transmitted by the SCP to the SSP at each stage of a call. However, usually the SCP is not used in the service logic of the Prepaid SIM IVR recharge application, i.e. calls to the IVR are routed by the CCF directly to the

IVR on the basis of the service number which the subscriber has dialled in order to recharge.

In the example illustrated in Figure 1, the prepaid subscriber information and information about vouchers are in a database located in a service management point SMP. Alternatively the information may be located in different databases and/or in some other network element, like a home location register HLR. The IVR interfaces the SMP database through a service management interface SMI. The SMP and the IP may be connected e.g. through a local area network (LAN) using the TCP/IP (Transmission Control Protocol/Internet Protocol). The connection between the IP and the SMP, illustrated by a dashed line, represents only management connection without any signalling connection, e.g. functions used to calculate the expiry time or times during recharge.

In a first preferred embodiment of the invention, predefined profiles are located also in the SMP and each subscriber's subscriber information comprises a profile identifier indicating which profile to use. Thus many subscribers can have the same profile but each subscriber has only one profile in the first preferred embodiment. A prepaid profile is a profile defining at least one of the following attributes: deposit function, expiry function, account maximum, maximum validity period and expiry state handling function. The deposit function defines how the new prepaid credit is calculated. The expiry function defines how the validity of the prepaid credit is calculated based e.g. on current validity, recharge amount, voucher used for recharge, etc. In those embodiments where the prepaid expiry handler has different states for progressively limiting the possibilities of the subscriber over time when no recharge is performed, the expiry state handling function may define for each state when the subscriber is in that state. The expiry state handling function may also define how and where to route calls in different situations, e.g. in different states. The expiry handling function or parts of it may also be included in the expiry function.

The expiry handling function may also be included in the expiry function.

The service management access point SMAP provides some selected users, such as service providers and network operators, with access to the service data of the service management point SMP through a public telephone network, such as the PSTN or the ISDN, a cellular radio network (such

as the GSM) or a public data network (X.25, the Internet) and an open interface. The SMAP interacts directly with the SMP. Furthermore, the SMAP can provide access to a network element of another telecommunications network, such as the home location register HLR comprising data related to subscriber information and telecommunications services. Functionally, the SMAP comprises a service management access function. The profiles can be defined and definitions changed via the SMAP. The SMAP is described in greater detail in PCT patent application WO98/41038 which is incorporated herein by reference.

Network operators and service providers are nowadays separated. A service provider buys the necessary bearer services from a network operator. A network operator may also be a service provider. An operator may also have multiple service providers.

Figure 2 shows an example of different profiles according to the first preferred embodiment of the invention. In the first preferred embodiment of the invention, prepaid services are built with prepaid expiry having different kinds of time limits. In the first preferred embodiment, the prepaid subscriber who has activated his subscription is in one of the five different subscription states, the states being active, near the credit expiry, credit expired, near subscription expiry and subscription expired. The state depends on how long has passed since the subscriber last time recharged. When the credit expires, the credit of a prepaid account is no longer valid. When the subscription expires, the subscription is no longer valid and the subscription is deactivated. The "near states" are states during which an announcement is given indicating what is going to happen soon if the account is not recharged. The prepaid expiry is described in greater detail in Finnish patent application FI990937 which is incorporated herein by reference.

Referring to Figure 2, a service provider has defined three different profiles: a Gold Profile in which the credit never expires and at each recharge a bonus is given; a Silver profile with a long credit validity and an Economy profile where the prepaid credit must be recharged frequently in order not to lose existing credit.

In the first preferred embodiment of the invention, the service attributes to be defined are a deposit function DF and an expiry function EF. In the first embodiment of the invention, it is assumed for the sake of clarity that the same basic function is used in every profile. However, it is possible to define

different functions for different profiles. In the first preferred embodiment of the invention, the deposit function is:

$$\text{new credit} = X_n \cdot \text{old credit} + (1 + \text{bonus}) \cdot \text{voucher value}$$

where  $X_n$  relates to what state the subscriber is in, e.g.  $X_1$  is used  
 5 when the subscriber is in the active state,  $X_2$  when the state is "near credit expiry",  $X_3$  in state "credit expired",  $X_4$  "near subscription expiry" and  $X_5$  in state "Subscription expired".

In the first preferred embodiment a max acc, i.e. maximum account credit, is also used. Thus, if a recharge results in a credit greater than the  
 10 maximum account credit, the recharge is not accepted and the voucher remains unused. In some other embodiments of the invention when the new credit exceeds the max acc, the new credit may also be set for example to the maximum value.

In the first preferred embodiment of the invention; the expiry func-  
 15 tion calculates the dates as follows:

$$\text{credit expiry date} = A + \text{credit period of a voucher} + T_3$$

where  $A$  defines whether to use the current date or the old credit  
 expiry date,  $T_3$  allows adjusting length period before the credit expires. For  
 20 example in the gold profile illustrated in Figure 2, the credit will expire when the subscription expires.

The other dates are calculated on the basis of credit expiry date in  
 the first preferred embodiment by formula:

$$\text{date} = \text{credit expiry date} + DT_n$$

where  $DT_n$  relates to time differences between credit expiry date  
 25 and other dates.  $DT_2$  is used to calculate the date when the state "near credit expiry" is entered,  $DT_4$  relates to the state "near subscription expiry" and  $DT_5$  "subscription expiry".

In the first preferred embodiment of the invention, a max time, i.e. a  
 maximum validity period, is also used. If a recharge results in the number of  
 30 days between recharge day and the credit expiry date exceeding the maximum validity period, then the new credit expiry date will be set to the current date plus the maximum validity period.

The maximum account credit and the maximum validity period val-  
 ues may be set into the profile definitions as in Figure 2 or the profile defini-  
 35 tions may indicate that such attributes are used and the actual values are in the subscriber specific information.

The functions described above in Figure 2 are only examples and meant to illustrate the invention. The service provider may compose different kinds of functions using different kinds of variables, constants, voucher properties, etc.

5 Figure 3 is a flow chart illustrating subscriber provisioning in the first preferred embodiment of the invention. In step 301 a subscriber number MSISDN is given to a subscriber, and in step 302 a profile is associated with the MSISDN in the subscriber information. The profile is identified with an identifier which can for example be a name like Gold, Silver and Economy in  
10 the example illustrated in Figure 2. After that, in the first preferred embodiment of the invention, a subscription expiry date is calculated in step 303 using the value of DT5 of Figure 2 defined in the profile. Then the subscriber information (including the MSISDN, the profile identifier and the subscription expiry date) is stored in step 304 in the SMP and the subscriber can activate his sub-  
15 scription by a recharge.

Figure 4 is a flow chart illustrating a recharge in the first preferred embodiment of the invention. It is assumed, for the sake of clarity, that the new voucher is valid, all necessary information will be obtained and the calling subscriber is a prepaid subscriber, otherwise he cannot recharge. Another as-  
20 sumption, made here, is that the subscriber recharges via the IVR yet without limiting the invention to that particular way to recharge. The invention may be used with other recharge media as well.

Referring to Figure 4, a subscriber has bought a voucher from a shop, called the IVR and selected to deposit the voucher. It is assumed that  
25 the IVR checks at the beginning of the call, if the caller is a prepaid subscriber, and if not, then the call is disconnected or connected to customer service. Figure 4 begins in step 401, where the IVR is prompting the subscriber for a voucher identification ID. The voucher identification number ID is received in step 402. The validity of the voucher is checked (not shown in Figure 4) and after that, in step 403, the IVR obtains the values of the voucher, e.g. the  
30 value to deposit and the credit period used by the deposit function DF and the expiry function EF described in greater detail in Figure 2. The IVR then obtains the subscriber's current credit and profile in step 404. Then the IVR analyzes the profile in step 405 in order to find out what information it needs to update subscriber information. In the first preferred information the necessary infor-  
35 mation is the current state so that the right value for  $X_n$  can be selected. In



step 406 the IVR obtains the necessary information and then the new credit is calculated in step 407 with the deposit function values indicated in the profile. After that the expiry dates are calculated in step 408 with expiry function values indicated in the profile. The updating is then ready and the subscriber is given, in step 409, an audio message telling the new credit and the credit expiry date.

The steps have not been set out in an absolute time sequence in Figures 3 and 4. Some of the above steps may take place simultaneously or in a different order, for example. Some steps may also be skipped, like steps 303 and 408 in embodiments where the expiry is not used. Other steps not shown in figures 3 and 4 may also take place between the steps stated above.

In some other embodiments a default profile may be used. It is automatically associated during provisioning with the subscriber information if no other profile is indicated, or the attributes of the default profile are used during recharge in cases when the subscriber has no profile associated directly with the subscriber information.

It is also possible to add the values of attributes, i.e. profile definitions, to the subscriber information during subscriber provisioning and this way associate the subscriber information with a profile. In these embodiments the subscriber information does not comprise a profile identifier but a whole profile definitions with values for attributes. However, separate profile definitions are more preferable, since they are less laborious and less susceptible to errors. A further advantage of using separate profile definitions instead of adding profile definitions to each subscriber's subscriber information is that a lot less memory is needed and changing profile definitions is much easier.

The present invention can be implemented in the existing network elements. They all have processors and a memory with which the inventive functionality described above may be implemented. The functions described above may be located in one network element or some of them may be in one element and the others in other elements regardless of how they are located in the examples used to illustrate the invention.

The accompanying drawings and the description pertaining to them are only intended to illustrate the present invention. Different variations and modifications to the invention will be apparent to those skilled in the art, without departing from the scope and spirit of the invention defined in the appended claims.

## Claims

1. A method for customizing a prepaid service in a telecommunications system, the method comprising the steps of:

maintaining subscriber information on at least one prepaid subscriber,

characterized by

defining at least two different profiles, each profile defining at least one attribute for the prepaid service;

associating the subscriber's subscriber information with one profile, providing the prepaid service to the subscriber as indicated by the attribute defined in the profile associated with the subscriber's information.

2. A method as claimed in claim 1, characterized by carrying out the associating during subscription provisioning.

3. A method as claimed in claim 1 or 2, characterized by the method further comprising the step of updating subscriber information during recharge as defined in the profile.

4. A method as claimed in claims 1, 2 or 3, characterized by the attribute being a deposit function defining how to calculate the credit during recharge.

5. A method as claimed in claims 1, 2 or 3, characterized by the attribute being an expiry function defining how to calculate the validity time of the prepaid credit.

6. A method as claimed in claims 1, 2 or 3, characterized by the attribute being an expiry state handling function defining how the possibilities of a subscriber are limited over time when no recharge is carried out.

7. A telecommunications system (S) offering prepaid subscription services, the system comprising at least one database (SMP) having subscriber information on at least one prepaid subscriber, characterized in that

the system (S) is arranged to maintain at least two different profiles, each profile defining at least one attribute for the prepaid service; to associate the subscriber's subscriber information with one profile; and to provide a prepaid service to the subscriber as indicated by the attribute defined in the associated profile.

8. A telecommunications system (S) as claimed in claim 7, characterized in that the attribute is a deposit function and the system (S) is

further arranged to calculate a subscriber's credit according to the deposit function defined in the profile associated with the subscriber's subscriber information.

9. A telecommunications system (S) as claimed in claim 7, characterized in that the attribute is an expiry function and the system (S) is further arranged to calculate a subscriber's credit validity according to the expiry function defined in the profile associated with the subscriber's subscriber information.

10. A telecommunications system (S) as claimed in claim 7, characterized in that the attribute is an expiry handling function and the system (S) is further arranged to limit the possibilities of a subscriber over time according to the expiry handling function defined in the profile associated with the subscriber's subscriber information.

11. A network element (IP) in a telecommunications system, where subscribers of the system can prepay for their calls by recharging their accounts via vouchers, the element including a database or a connection to a database (SMP) having subscriber information of prepaid subscribers,

characterized in that

the network element (IP) is arranged to have access to profile definitions, each profile defining at least one attribute for the prepaid service, and to update the subscriber information during recharge according to a profile associated with the recharging subscriber's subscriber information.

**(57) Abstract**

In order to provide possibility to customize a prepaid service in a telecommunications system, at least two different profiles (Gold, Silver, Economy) are defined, each profile defining at least one attribute (DF, EF) for the prepaid service. A subscriber's subscriber information is associated with one profile and the prepaid service is provided to the subscriber as indicated by the attribute defined in the profile associated with the subscriber's information.

(Figure 2)

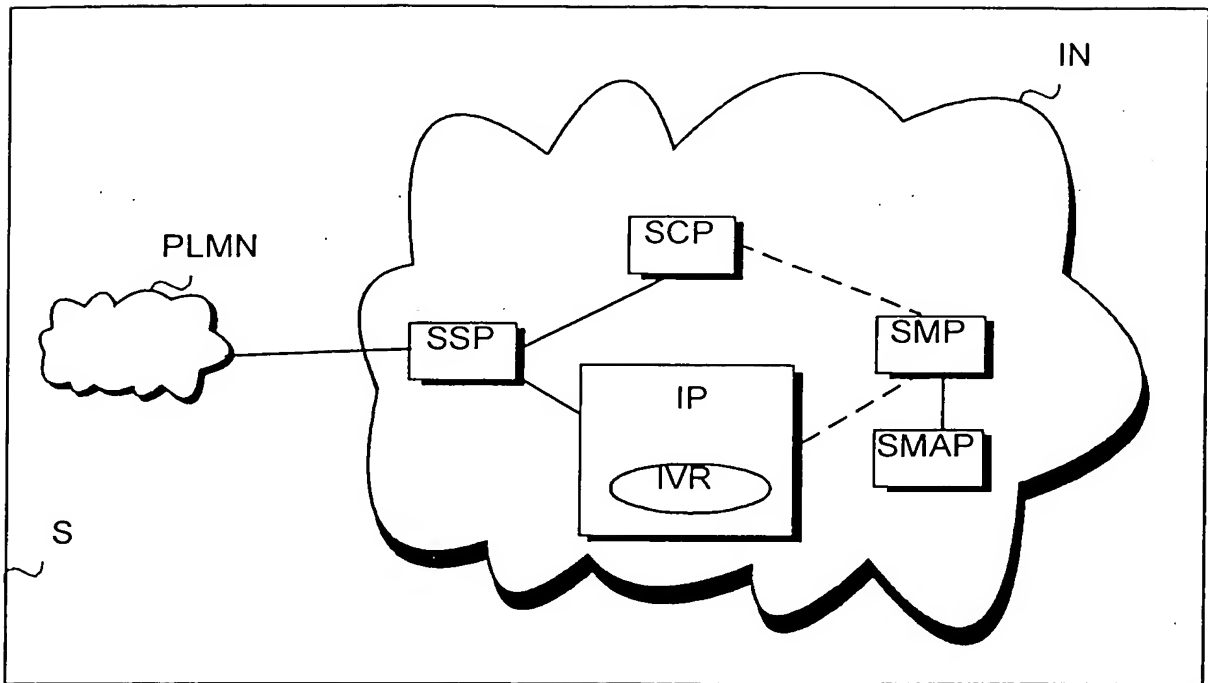


FIG.1

	Gold	Silver	Economy
DF			
Bonus	0,1	0	0
X1	1	1	1
X2	1	1	0,9
X3	1	0,5	0
X4	1	0,4	0
X5	1	0	0
Max Acc	None	None	500
EF			
A	Later than old or current	Old	Current
T3	365	1	0
DT2	-335	-30	-15
DT4	-335	150	45
DT5	-365	180	65
Max time	None	None	30

FIG.2

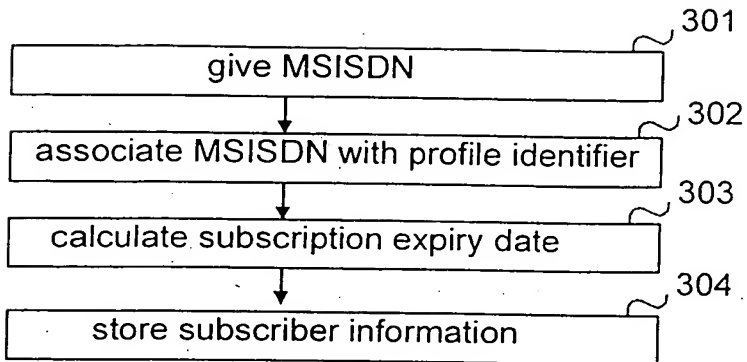


FIG. 3

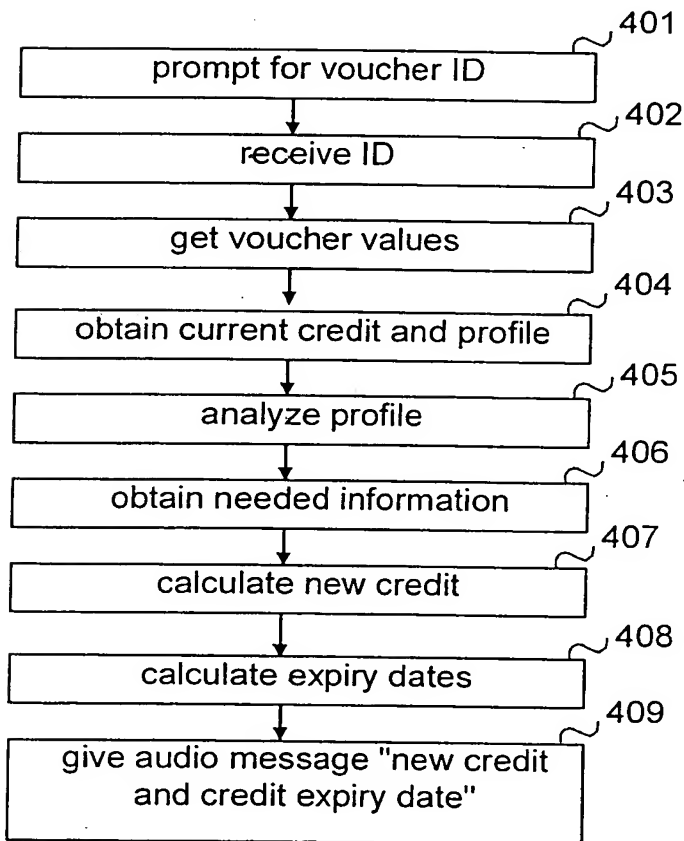


FIG. 4